The Persistence of *Shigella flexneri* in the United States: Increasing Role of Adult Males

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Abstract: The annual reported isolation rate of *Shigella flexneri* decreased from 1964 to 1973, but has remained constant since then at 1 per 100,000. Between 1975 and 1985, the median age of males from whom *S. flexneri* was isolated rose from 5 to 26 years. During this time, the isolation rate of *S. flexneri* rose more than five-fold among men, did not change in adult women, and decreased in children. By 1985, 23 per cent of reported *S. flexneri* isolates came from men aged 20–49. Increased male homosexual transmission of *S. flexneri* is a possible explanation for these findings. (*Am J Public Health* 1988; 78:1432–1435.)

Introduction

Shigella flexneri has been replaced by *S. sonnei* as the most frequently reported *Shigella* serotype in many industrialized nations.[1] In the United States, the number of reported *S. flexneri* isolates declined steadily from 1964 to 1973, and the proportion of *Shigella* isolates that were *S. flexneri* dropped from 60.6 per cent to 15.5 per cent.[2] This decline stopped in 1974, and the number of reported isolates of *S. flexneri* has remained nearly constant since. We reviewed national *Shigella* surveillance data from 1967 to 1985 to examine and explain the persistence of *S. flexneri* in the United States.

Methods

The national *Shigella* surveillance system, organized in 1963, reached full national participation in 1967; since then all states except California have contributed continuously.* It is a passive, laboratory-based surveillance system which receives weekly reports of isolates and accompanying demographic information from state health departments. Duplicate isolates are excluded. No clinical information is provided, and asymptomatic excretors are not distinguished from the acutely ill. It has been estimated that 5 per cent of *Shigella* infections are reported.[3] Reporting forms, coding and data management have remained constant since the inception of the system.

Because the specific serologic subtype is often not reported, we grouped serotypes as *S. flexneri* 1, (serotypes 1a, 1b, and 1 unspecified); *S. flexneri* 2, (2a, 2b, and 2 unspecified); *S. flexneri* 3, (3a, 3b, 3c, and 3 unspecified); and *S. flexneri* 4, (4a, 4b, and 4 unspecified). Age-specific isolation rates were calculated based on the annual 49-state US civilian population. City-specific data were derived from the county-based *Shigella* surveillance system, by using the counties included in the Standard Metropolitan Statistical Areas (SMSAs) of the 21 largest cities outside of California.[4]

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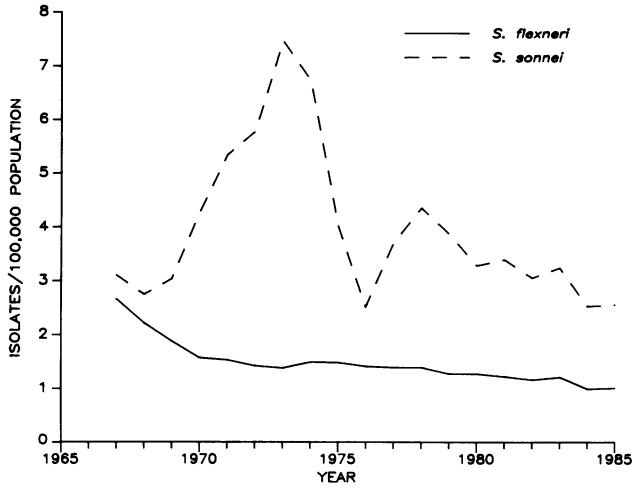
*California did not report isolates between 1968 and 1973, and has not reported age-, sex-, or residence-specific data since then.

Results

The isolation rate of *Shigella flexneri* declined through 1973, and has been relatively stable since then at approximately 1 per 100,000 population (Figure 1). In the past, persons in custodial institutions and persons on Indian reservations have been at high risk for *S. flexneri* infections. However, the number of *S. flexneri* isolates reported from these groups has been decreasing, particularly from custodial institutions (Table 1). Although many isolates do not have a reported residence, these two groups accounted for only 5.9 per cent of all *S. flexneri* isolates for which a residence was reported during 1979–84.

A profound demographic shift in persons from whom *S. flexneri* isolates were reported began in 1976 (Figure 2). The reported age began to increase, particularly in males, whose median age rose from 5 years in 1975 to 26 years in 1985. This is the combined effect of a decrease in the age-specific isolation rates for children and an increase in the isolation rate among adult men (Figure 3). The greatest increase occurred among men 30 to 39 years of age. In this age group the isolation rate of *S. flexneri* climbed fom 0.26 per 100,000 in 1970 to 1.41 per 100,000 in 1985 (Figure 4). By comparison the isolation rate among women in the same age group did not change, and the rate among young children decreased substantially. The increase in median age among females since 1983 is the result of the decreased isolation rate among



*REPORTED TO THE NATIONAL SHIGELLA SURVEILLANCE SYSTEM, EXCLUDING CALIFORNIA.

FIGURE 1—Isolation Rate of *S. flexneri* and *S. sonnei* Reported through the National *Shigella* Surveillance System, 49 States, United States, 1967–85

TABLE 1—*S. flexneri* Isolates Reported from High-Risk Groups in the United States, by 6-Year Interval, 1967–84

Interval	No. *S. flexneri* with Residence Reported	Mental Institutions # Isolates	Mental Institutions (% of Total)	Indian Reservations # Isolates	Indian Reservations (% of Total)
1967–72	8257	3136	(38.0)	455	(5.5)
1973–78	6588	1029	(15.6)	515	(7.8)
1979–84	5726	72	(1.3)	264	(4.6)
1967–84	20571*	4237	(20.6)	1234	(6.0)

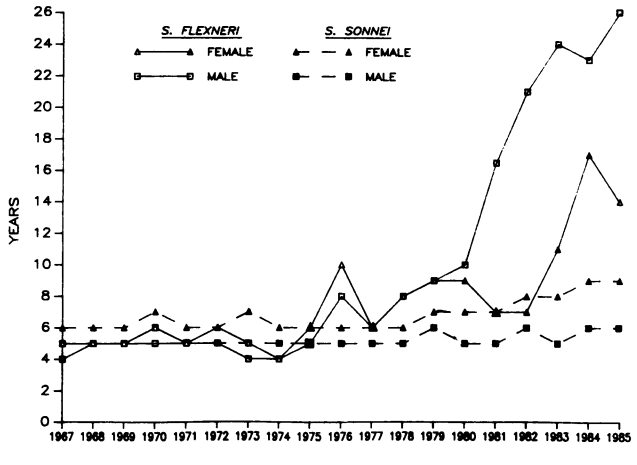
*Representing 29 per cent of all reported *S. flexneri.*

children, and not to an increase in the isolation rate among adult women. In 1970, 5.5 per cent of all reported *S. flexneri* isolates came from men aged 20–49; this proportion increased to 23 per cent in 1985.

These changes in age- and sex-specific isolation rates can be seen in the individual serologic subgroups of *S. flexneri*. The isolation rate of serogroup 1 among men increased sharply in 1980, without a similar increase that year among adult women (Figure 5). The other *S. flexneri* serogroups also show striking temporary increases among adult men without parallel increases among women or children: *S. flexneri* four in 1974, *S. flexneri* two in 1978, *S. flexneri* three again in 1983, and *S. flexneri* four in 1984.

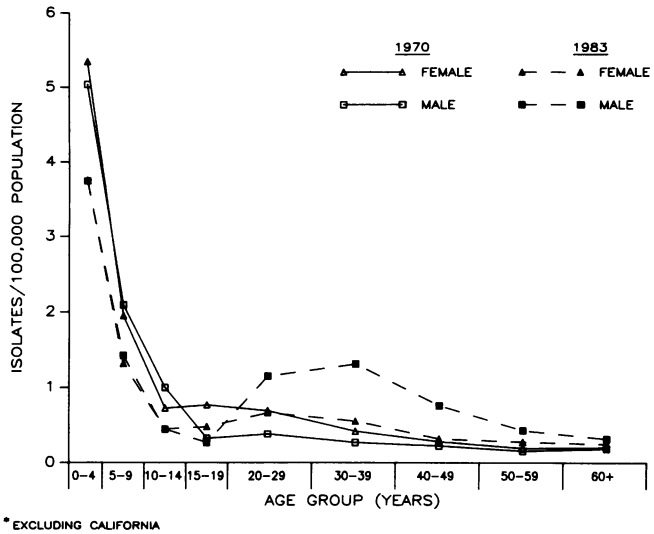
The increase in *S. flexneri* isolations among adult men is particularly evident in large cities (Table 2). In the 21 largest cities in the United States outside of California, in the period 1967–72, isolates of *S. flexneri* from women 20–49 years of age equaled or outnumbered those from men of the same age in all but two of these cities. In the period 1973–78, isolates from men became more frequent, exceeded those from women in eight of these cities, and accounted for over half of all *S. flexneri* reported in the US in that age- and sex-group. In the period 1979–84, these trends continued, and isolates from men exceeded those from women in 16 of these cities.

In contrast, the median age of persons with *S. sonnei* has not shifted markedly (Figure 2). In 1970, men aged 20–49 years accounted for 8 per cent of isolates of *S. sonnei*, in 1985 this proportion was 10 per cent. In 17 of the 21 cities



*EXCLUDING CALIFORNIA

FIGURE 2—Median Age of Persons from Whom Isolation of *S. flexneri* and *S. sonnei* Was Reported, by Sex, 49 States, United States 1967–85



*EXCLUDING CALIFORNIA

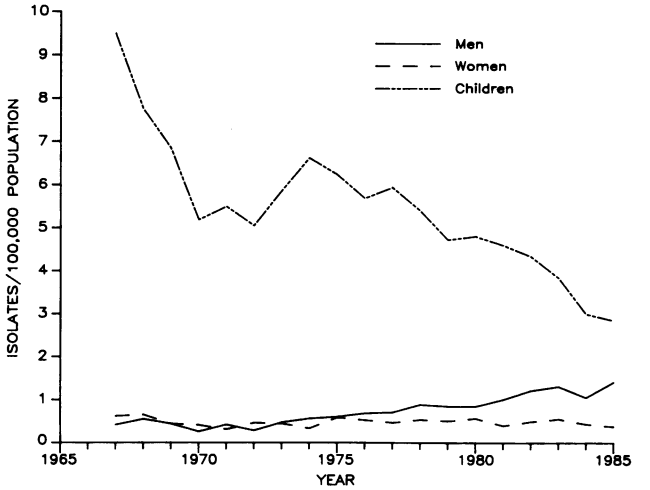
FIGURE 3—Age- and Sex-specific Isolation Rates of *S. flexneri*, 49 States, United States, 1970 and 1983

examined above, *S. sonnei* was isolated from more women than men aged 20–49 in the six-year period 1979–84. Sixty-three per cent of *S. dysenteriae* from persons ages 20 to 49 in 1967–72 came from men, 46 per cent in 1973–78, and only 44 per cent in 1979–84.

Discussion

Interpretation of national *Shigella* surveillance data is hampered by the limited information reported with each isolate, by regional variation in case ascertainment and reporting, and by changes in the delivery of medical care over time. However, laboratory methods for culturing and serotyping *Shigella* have changed little in the last 20 years, and the surveillance system itself has remained virtually constant since its inception. Internal comparisons suggest secular trends for the nation as a whole.

S. flexneri has persisted in the United States despite a steady decline in the rate of isolation from children, and a



*EXCLUDING CALIFORNIA

FIGURE 4—Isolation Rates of *S. flexneri* in Children less than 5 Years old and Men and Women Aged 30–39, 49 States, United States, 1967–85

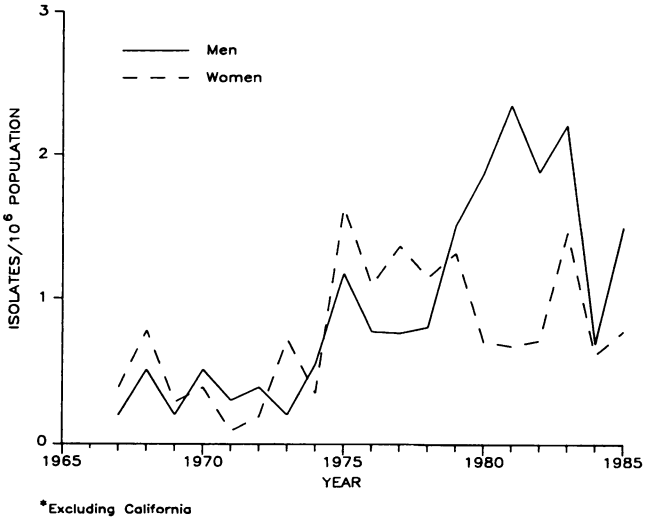


FIGURE 5—Isolation Rate of *S. flexneri* Serogroup 1 in Men and Women Aged 30–39, 49 States, United States, 1967–85

decrease in the number of reported isolates from Indian reservations, and custodial institutions. This persistence has been accompanied by a striking increase in the isolation rate among adult men; approximately one-fourth of reported *S. flexneri* isolates now come from adult men. In many large cities, infection restricted to adult men appears to have supplanted the traditional cycle of *S. flexneri* infections in children and their caretakers. Individual serogroups of *S. flexneri* have gained national predominance among adult men in a sequential fashion without similar increase in women or children. These observations suggest that the urban-dwelling man aged 20–49 is at particular risk for *S. flexneri*, and that transmission restricted to this group may explain much of the persistence of the serogroup.

There are several possible explanations for the increasing role of the adult male. Men may participate more in the care of ill children, but this would not explain selective increases in serotypes restricted to adult men. Men may travel more than women, although one might expect travel-associated shigellosis to represent a broad spectrum of serotypes, rather than successive waves of individual serotypes, and *S. dysenteriae*, a travel-associated serotype, is more frequent among women than men. An increase in the number of homeless men, particularly those discharged from mental institutions, may play a role, although *S. flexneri* has not been documented as a particular problem of the homeless. An increase in adult male immigration from Latin America to the urban United States is a likely but undocumented contributing factor. Male homosexual transmission is also likely to be an important factor, if *S. flexneri*, like other established homosexually transmitted diseases, has become common among young, urban male homosexuals.[5] The relative importance of these explanations cannot be ascertained from the national surveillance data.

TABLE 2—Reported *S. flexneri* Isolates from 20- to 49-year-old Persons by Sex in the 21 Largest United States Cities,* by Year of Report, 1967–84

Population Group	1967–72 Male/Female	1973–78 Male/Female	1979–84 Male/Female
21 Cities Total:	187/301	721/499	1240/625
(Proportion male)	(0.38)	(0.59)	(0.66)
US total for age group*	878/1192	1402/1351	2383/1474
(Proportion male)	(0.42)	(0.51)	(0.62)
Proportion of US total for age and sex group accounted for by the 21 cities	0.21/0.25	0.51/0.37	0.52/0.42

*Excluding California

Male homosexual shigellosis was first noted in San Francisco in 1974, the year that the national upward trend in *S. flexneri* isolates from men began.[6] In that city, *S. flexneri* 2a was initially predominant among male homosexuals, followed by *S. flexneri* 3a, and then *S. sonnei*.[7] In Seattle the following year, *S. flexneri* 3 was the predominant serogroup among male homosexuals and *S. sonnei* also appeared to be transmitted among male homosexuals; 30 per cent of all shigellosis reported in 1975 occurred in male homosexuals.[8] Among men with shigellosis at the New York Hospital in 1970–75, 58 per cent of those without recent travel were homosexual, compared to 10 per cent of those with recent travel.[9] By 1985, shigellosis in San Francisco was largely a disease of homosexual men: 82 per cent of all reported *Shigella* was *S. flexneri*, and 66 per cent of patients with shigellosis were homosexual or bisexual men.[10] The relative rarity of *S. sonnei* in San Francisco is curious, since this is by far the most common serogroup in the US, and raises the question of whether *S. flexneri* is more efficiently transmitted than *S. sonnei* by homosexuals. Although immunosuppressed adults may develop severe *Shigella* bacteremia, the effect of AIDS (acquired immunodeficiency syndrome) on *Shigella* transmission is not known.[11]

It remains to be established whether homosexual transmission explains the nationwide increase in *S. flexneri* isolations from adult men. If it does, reducing the incidence of these infections may require new control strategies, beyond emphasizing handwashing and food hygiene. The homosexual practices likely to transmit *Shigella* are oral-anal and oral-genital sex. Changes in the prevalence of these practices because of concern about AIDS could have some impact on *S. flexneri*.[6,8,12–14] In San Francisco, reported shigellosis decreased by 30 per cent from 1981 to 1985.[10] This decrease may be analogous to recent reports of decreases in rectopharyngeal gonorrhea in men in New York City,[15] and in gonorrhea in men in Denver,[16] and London.[17] However, the continued nationwide increase in *S. flexneri* isolations from adult men through 1985 suggests that such behavior changes are not widespread, or that non-sexual transmission among adult men is also important. In some areas, case-investigation of *S. flexneri* reported from men may help identify those in need of health education about AIDS.

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OTA Special Report: Biology, Medicine, and the Bill of Rights

By effectively forcing people to make life and death decisions about themselves, about other people, and even future generations, the new genetic and medical technologies are raising questions about the meaning and scope of constitutional principles, according to a recent report from the Congressional Office of Technology Assessment (OTA).

Constitutionally, the central question becomes: would State regulation of these decisions impinge on some individual liberty that is guaranteed by the Bill of Rights? And, if so, is the individual's interest in exercising that right outweighed by the contrary interest of the State — considered to be the "public interest"?

Whether the government can or should regulate biotechnology is not an abstract question, according to Representative Robert W. Kastenmeier (D-WI) of the House Committee on the Judiciary. "It involves matters of birth and death, heredity and new life forms, disease and aging," he noted. In view of these and similar policy issues, he requested OTA to assess how the laws, institutions and scientific research might move forward together. This report is the result of that effort.

According to OTA, other decisions include the patenting of living organisms, using fetal tissues for research, human cell therapy, prenatal diagnosis and treatment, mandatory testing for genetic or infectious diseases, the right to treatment, and the right to refuse treatment. Is there a constitutional right to do research? Should there be areas of "forbidden knowledge"? What values should be reflected in federal research funding allocation and federal guidelines?

Some traditional public health practices — constitutionally long- established under State police powers — are almost certain to be challenged anew because of today's broader interpretation of individual rights of privacy and autonomy, according to OTA, This is occurring, for example, in the context of the AIDS epidemic with regard to mandatory reporting, contact tracing, mandatory testing, occupational or educational restrictions, and quarantine.

Copies of the OTA 124-page special report, *Biology, Medicine, and the Bill of Rights,* are available from the Government Printing Office, Superintendent of Documents, Washington, DC 20402. Tel: (202) 783-3238. GPO stock number 052-003-01133-6. The price is $4.25.